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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/634,764	08/07/2000	Ingrid B. Carlbom	2925-451P	3428

30595 7590 10/22/2003

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EXAMINER	
PHAN, THAI Q	
ART UNIT	**PAPER NUMBER**
2123	8

DATE MAILED: 10/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/634,764	Applicant(s) Carlbom et al.
	Examiner Thai Phan	Art Unit 2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Aug 11, 2003*.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-34* is/are pending in the application.

4a) Of the above, claim(s) ______ is/are withdrawn from consideration.

5) ☐ Claim(s) ______ is/are allowed.

6) ☒ Claim(s) *1-34* is/are rejected.

7) ☐ Claim(s) ______ is/are objected to.

8) ☐ Claims ______ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on ______ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on ______ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ______.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☒ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). ______

4) ☐ Interview Summary (PTO-413) Paper No(s). ______

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other:

DETAILED ACTION

This Office Action is in response to applicant's amendment and response filed on Aug. 11, 2003. Claims 1-34 are pending in this Office Action.

Drawings

1. Formal drawings filed on Feb. 27, 2001 are accepted.

Claim Rejections - 35 USC § 112

2. Due to applicant's amendment to the claim, the 35 U.S.C. 112 claim rejection has been withdrawn.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-4, 6-11, 18-21, and 23-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagamitsu et al., US patent no. 5,467,401.

As per claim 1, Nagamitsu discloses a sound environment simulator for measure of sound wave effects with feature limitations very similar to the claimed invention (Abstract and

Summary of the Invention). According to Nagamitsu, the method of modeling sound wave propagation in the spatial 3-dimensional environment includes steps of

computing wave propagation paths from sources to other regions in the space model or the spatial environment (col. 5, lines 1-22, col. 6, line 16 to col. 7, line 45, for example),

generating at least reverberation or echo path between the source and a receiver based on at least one computed wave propagation path as claimed (Figs. 9, 10, col. 8, line 49 to col. 9, line 10, for example). Nagamitsu discloses impulse responses for each incident location, incident directions from sound waves reflection in various directions, and sound bands (col. 8, line 66 to col. 9, line 10, for example) and ordering of sound waves (col. 10, lines 47-52) based on weight corresponding to the arrival time for sound ray tracing for wave reflections directly or indirectly, wherein the arrival time is computed from traveling distance from source to destination (col. 7, lines 5-17, col. 8, lines 39-41), which is similar to travel path priority as defined in the present specification because the arrival time is dependent on travel path or distance, and it is weighted based on travel time priority. Nagamitsu does not expressly disclose a priority order of computing wave propagation as claimed.

Practitioner in the art at the time of the invention was made would have found Nagamitsu disclosure of ordering of reflection of incident waves, directly from sound sources or indirectly from reflection waves, by assigning weight to arrival time or timestamp of wave arrivals with taking travel path into consideration in order to time stamp or weighted arrival time for incident waves (see col. 7, lines 5-17), and computing wave responses for all incident waves for each direction as in cols. 8, 9, and 10 implies the claimed limitation of priority order of computing

wave propagation in order to reflect sound waves incident directly form sound sources or indirectly from reflection such that memory capacity would be increased, and faster simulator in sound environment would be obtained as disclosed in col. 10, lines 2-11, lines 30-35, lines 43-45, for example.

As per claim 2, Nagamitsu discloses method of modeling acoustic wave propagation in 3-D environment (Figs. 1-6).

As per claim 3, Nagamitsu discloses memory (18) for storing indexed sections of sound source patterns which would obviously imply a data structure being used for storing sections of sound sources and its propagation path information for efficient storage and computation (Figs. 5, 6, cols. 5-8).

As per claim 4, Nagamitsu discloses step of tracing propagation paths through the spatial environment step of representing sound environment surface as cell adjacent graph and traversing such graph in order to simulate sound in the environment (col. 5, lines 60-63, for example).

As per claims 6-7, Nagamitsu discloses sound source and sound receiver are moving (cols. 10-11).

As per claim 8, Nagamitsu discloses impulse response and convolving the impulse response with a source signal to generate a spatialized output signal as claimed (Figs. 5-10, cols. 7-9).

As per claim 9, Nagamitsu discloses encoded data in spatial environment (Figs. 5-6, for example).

As per claim 10, Nagamitsu models acoustic reverberation paths between avatar locations such as in concert hall, for example (Background of the Invention).

As per claim 11, Nagamitsu discloses sound source data and propagation paths are encoded for structure sections and stored in memory (Figs. 5, 6, col. 5, lines 25-55), such structure sections with encoded information stored in memory are called data structure as obviously known for those skilled in the computer computation art for effectively simulating acoustic sound effects in spatial environment using the ray tracing techniques (col. 5, line 60 to col. 6, line 2, for example). Nagamitsu also discloses assigning weight corresponding to the arrival time, including early arrival time, for each sound ray in ray tracing (col. 8, lines 39-41).

As per claim 18, Nagamitsu discloses a sound environment simulator for measure of sound wave effects with feature limitations very similar to the claimed invention (Abstract and Summary of the Invention). According to Nagamitsu, the apparatus of modeling sound wave propagation in the spatial 3-dimensional environment includes means for

computing wave propagation paths from sources to other regions in the spatial environment (col. 5, lines 1-22, col. 6, line 16 to col. 7, line 45, for example),

generating at least reverberation or echo path between the source and a receiver based on at least one computed wave propagation path as claimed (Figs. 9, 10, col. 8, line 49 to col. 9, line 10, for example). Nagamitsu discloses impulse responses for each incident location, incident directions from sound waves reflection in various directions, and sound bands (col. 8, line 66 to col. 9, line 10, for example) and ordering of sound waves (col. 10, lines 47-52) based on weight corresponding to the arrival time, which is based on travel path, which is equivalent to path

priority (col. 7, lines 5-17, col. 8, lines 39-41) because the arrival time is weighted based on travel time from source to destination distance for sound ray tracing for wave reflections directly or indirectly (col. 8, lines 39-41). Nagamitsu does not express disclose a priority order of wave propagation.

Practitioner in the art at the time of the invention was made would have found Nagamitsu disclosure of ordering of reflection of incident waves, directly from sound sources or indirectly from reflection waves, including weight assigned to arrival time, and computing wave responses for all incident waves for each direction as in cols. 8, 9, and 10 implies the claimed limitation of a priority order of computing wave propagation in order to reflect sound waves incident directly form sound sources or indirectly from reflection with taking travel path into consideration in order to time stamp or weighted arrival time for incident waves such that memory capacity would be increased, and faster simulator in sound environment would be obtained as disclosed in col. 10, lines 2-11, lines 30-35, lines 43-45, for example.

As per claim 19, Nagamitsu discloses the apparatus for modeling acoustic wave propagation or sound reverberation in 3-D environment (Figs. 1-6).

As per claim 20, Nagamitsu discloses memory (18) for storing indexed sections of sound source patterns which would obviously imply a data structure being used for storing sections of sound sources and its propagation path information for efficient storage and computation (Figs. 5, 6, cols. 5-8).

As per claim 21, Nagamitsu discloses step of tracing propagation paths through the spatial environment step of representing sound environment surface as cell adjacent graph and

traversing such graph in order to simulate sound in the environment (col. 5, lines 60-63, for example).

As per claims 23 and 24, Nagamitsu discloses sound source and sound receiver are moving (cols. 10-11).

As per claim 25, Nagamitsu discloses means for performing impulse response and convolving the impulse response with a source signal to generate a spatialized output signal as claimed (Figs. 5-10, cols. 7-9).

As per claim 26, Nagamitsu discloses reverberation paths between source and receivers are encoded and stored in computer memory. Such memory could include a data structure for storing encoded data structure in an efficient manner for ray tracing techniques (Figs. 5-6, col. 5, lines 60-64, for example).

As per claim 27, Nagamitsu models acoustic reverberation paths between avatar locations such as in concert hall for multiuser environment, for example (Background of the Invention).

As per claim 28, Nagamitsu discloses sound source data and propagation paths are encoded for structure sections and stored in memory (Figs. 5, 6, col. 5, lines 25-55), such structure sections with encoded data are stored in memory are called data structure as obviously known in the computer computation art for effectively simulating acoustic sound effects in spatial environment. Nagamitsu also discloses assigning weight corresponding to the arrival time for each sound ray in ray tracing (col. 8, lines 39-41) based on travel distance from source to destination (col. 7, lines 5-17)..

5. Claims 5, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagamitsu et al., US patent no. 5,467,401 as applied to claims 1, and 18, respectively above, and further in view of Reed et al., 5,574,466.

As per claim 5, Nagamitsu discloses sound simulation method for virtually simulating sound effect in space model or spatial environment (see claim 1 rejection above). Nagamitsu does not expressly disclose beemtree with tree node and node priority value as claimed. Such features are well-known in the art. In fact, Reed teaches data structure as tree being used in ray tracing (Figs. 2, 14, col. 3, line 50 to col. 4, line 9, col. 5, lines 8-63, col. 7, lines 1-15, for example), with tree nodes, nodal arrival time or priority, etc. as claimed, to improve memory storage and computation speed in ray tracing techniques.

This would motivate practitioner in the related art at the time of the invention was made to combine Reed teaching of tree data structure to store model data into ray tracing techniques as disclosed in Nagamitsu to modify Nagamitsu disclosure in order to improve computation and memory storage as taught in Reed in the Background of the Invention.

As per claim 22, Nagamitsu discloses sound simulation method for virtually simulating sound effect in spatial environment (see claim 18 rejection above). Nagamitsu does not expressly disclose beemtree with tree node, cell boundary, and node cell priority value as claimed. Such features are well-known in the art. In fact, Reed teaches data structure for modeling wave propagation in spatial environment as beam tree for ray tracing (Figs. 2, 14, col. 3, line 50 to col. 4, line 9, col. 5, lines 8-63, col. 7, lines 1-15, for example), with beam tree characteristics such as tree node locations, nodal arrival time for priority, cell boundary for

environment corners, etc. as claimed, to improve memory storage and computation speed in ray tracing techniques.

This would motivate practitioner in the related art at the time of the invention was made to combine Reed teaching of tree data structure to store model data into ray tracing techniques as disclosed in Nagamitsu to improve computation and memory storage as taught in Reed in the Background of the Invention.

6. Claims 12-17, and 29-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagamitsu, Patent no. 5,467,401, in view of Reed et al., US patent no. 5,574,466.

As per claim 12, Nagamitsu discloses method of modeling coherent wave propagation in a spatial environment with feature limitations substantially similar to the claimed invention (Abstract and Summary of the Invention). According to Nagamitsu, the modeling method includes steps of

constructing sound source data by tracing beam bidirectionally because ray tracing techniques trace or detect directive sounds directly incident on receiver from various sound sources (col. 5, line 59 to col. 6, line 12) between a plurality of sound sources, including a pair of sound sources, in the spatial environment (col. 7, line 63 to col. 8, line 7, for example),

and computing a filter response for at least one path between the pairs (cols. 7-8). Nagamitsu does not expressly disclose a specific data structure like tree as claimed.

Such feature is well-known in the art. In fact, Reed teaches method and system for encoding wave propagation data in tree structure for used in ray tracing (Figs. 2, 14, col. 5, lines 8-63, for example) to improve memory storage and computation speed in ray tracing techniques.

This would motivate practitioner in the related art at the time of the invention was made to combine Reed teaching of tree data structure to store model data into ray tracing techniques as disclosed in Nagamitsu to improve computation and memory storage as taught in Reed in the Background of the Invention.

As per claim 13, Nagamitsu discloses sound source simulation between an audio source and a receiver location (Summary of the Invention).

As per claim 14, Reed teaches tree structure for storing traced ray (Figs. 2 and 14), and such beamtree could be encoded for reverberation paths as disclosed in Nagamitsu.

As per claim 15, Reed teaches tracing adjacent cells or nodes in the structure beam tree in a spatial environment.

As per claim 16, Nagamitsu discloses computing reverberation source paths between the plurality of sources (cols. 5 and 6), and Reed teaches tracing beam tree in ray tracing techniques (Fig. 2, 14, col. 5, lines 8-63, col. 7, lines 15-65, for example).

As per claim 17, Nagamitsu discloses such limitations in virtual sound simulation in spatial regions as claimed.

As per claim 29, Nagamitsu discloses apparatus for modeling coherent wave propagation in a spatial environment with feature limitations substantially similar to the claimed invention

(Abstract and Summary of the Invention). According to Nagamitsu, the modeling apparatus includes means for

constructing sound source data by tracing beam bidirectionally because ray tracing techniques trace directive sound waves directly incident on user receiver from various sound sources (col. 5, line 59 to col. 6, line 12) between a plurality of sound sources, including a pair of sound sources, in the spatial environment (col. 7, line 63 to col. 8, line 7, for example),

and computing a filter response for at least one path between the pairs (cols. 7-8). Nagamitsu does not expressly disclose a specific data structure, for example, tree as claimed. Such feature is well-known in the art. In fact, Reed teaches method and system for modeling wave propagation in tree data structure for ray tracing, such tree structure is called beamtree (Figs. 2, 14, col. 5, lines 8-63, for example) to improve memory storage and computation speed in ray tracing techniques.

This would motivate practitioner in the related art at the time of the invention was made to combine Reed teaching of tree data structure to store model data into ray tracing techniques as disclosed in Nagamitsu to improve computation and memory storage as taught in Reed in the Background of the Invention.

As per claim 30, Nagamitsu discloses sound source simulation between an audio source and a receiver location (Summary of the Invention).

As per claim 31, Reed teaches tree structure or beam tree structure for modeling traced ray (Figs. 2 and 14), and encoding for reverberation paths in sound simulation environment as disclosed in Nagamitsu.

As per claim 32, Reed teaches tracing adjacent cells or nodes via structure of beam tree in a spatial environment which could include the claimed limitation for tracing adjacent cells.

As per claim 33, Nagamitsu discloses computing reverberation source paths between the plurality of sources (cols. 5 and 6), and Reed teaches tracing beam tree in ray tracing techniques (Fig. 2, 14, col. 5, lines 8-63, col. 7, lines 15-65, for example).

As per claim 34, Nagamitsu discloses such limitations in virtual sound simulation in spatial regions as claimed.

Response to Arguments

7. Applicant's arguments filed Aug. 11, 2003 have been fully considered but they are not persuasive.

In response to applicants' argument that Nagamitsu disclosure does not imply or expressly disclose priority order sound reflection (page 7, last paragraph), the examiner disagrees with. Nagamitsu discloses wave reflections including direct reflections and mirror reflections indirectly from sound sources due to three dimensional space environment having various wave propagation paths. Nagamitsu also discloses reflection orders such as higher order and lower order reflections and analyzing the ordered reflection waves (sounds) by assigning weight to arrival time of sound waves or timestamp of wave arrivals, with taking traveling path into consideration in order to time stamp or weighted arrival time for incident waves (col. 7, lines 5-16) which is equivalently to travel path priority as claimed, and computing wave responses for all incident waves for each direction as in cols. 8, 9, and 10 could imply the claimed limitation of

priority order of computing wave propagation in order to reflect sound waves incident directly form sound sources or indirectly from reflection such that memory capacity would be increased, and faster simulator in sound environment would be obtained as disclosed in col. 10, lines 2-11, lines 30-35, lines 43-45 for example, to enhance the work efficiency of computation and memory (col. 10, lines 46-51, for example). Such sound orderings above reflect a priority of sound reflection in order to enhance computation efficiency and memory management, and to reproduce a realistic sound field for user (col. 11, lines 4-28, for example).

In response to applicant's argument the Nagamitsu fails to show lower order reflections and higher order reflection (page 8, last paragraph), the examiner responds such argued feature of higher order reflection and lower order reflections are disclosed in Nagamitsu, col. 10, lines 46-52, for example. Such ordering of sound wave reflections in the model space (10) or spatial model as claimed take wave propagation paths from source to other regions to compute sound effects and to reproduce a realistic sound field for listener (cols. 8-11).

In response to applicants' argument Nagamitsu disclosure does not imply or expressly disclose priority order sound reflection (page 9, paragraph 3), the examiner disagrees with. As discussed above, Nagamitsu discloses wave reflections including direct reflections and mirror reflections in space model or spatial environment as argued. Nagamitsu also discloses reflection orders such as higher order and lower order reflections and analyzing the ordered reflection waves (sounds) to enhance the work efficiency of computation and memory (col. 10, lines 46-51, for example). Such sound orderings above reflect a priority of sound reflection in order to

enhance computation efficiency and memory management, and to reproduce a realistic sound field for user (col. 11, lines 4-28, for example).

In response to applicants argument there would be no motivation to combine Nagamitsu with Reed in modeling wave reflection in a space model or spatial environment (page 9, last paragraph). The examiner disagrees with. Both references are directed to method and system for tracing ray or tracing waves propagation in a three dimensional space or spatial environment. Sound waves or electromagnetic waves are propagation waves. The receive waves at the other end are direct wave from sources, or could be waves reflected from surrounding areas. Due to its wave propagation and wave reflection in the such environment, it would have been obvious for practitioner in the art at the time of the invention was made to consider wave propagation as in electromagnetic wave propagation as taught in Reed into Nagamitsu sound wave propagation simulation in order to complete a simulation model for wave propagation because electromagnetic wave propagation is well studied and understood in the art.

In response to applicants' argument the prior art of record fails to disclose constructing a data structure for wave tracing (page 10, paragraphs 3 and 4), the examiner disagrees with. Reed teaches a computation data structure preferably tree structure being used for storing and tracing waves propagation in three dimensional space or spatial environment as claimed (Figs. 2, 14, col. 5, lines 8-63, for example).

In response to applicants' argument bidirectionally tracing beams, the examiner responds such argued feature is in Nagamitsu ray tracing for tracing waves directly incident or indirectly reflect from various sound sources in order to analyze effects such as sound quality, noise, or

interference of sounds received at the listener in the spatial environment or 3 dimensional space environment.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thai Phan whose telephone number is (703) 305-3812.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703)305-3900.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9306, (for formal communications intended for entry);

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington. VA., Sixth Floor (Receptionist).

October 20, 2003

Thai Phan
Patent Examiner
Thai Phan
AU 2123